Detecting toxic cyanobacterial strains in the Great Lakes, USA

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Introduction

Some regions in the Great Lakes have been experiencing a resurgence of the cyanobacterial harmful algal bloom (HAB) genera *Microcystis*. Blooms of *Microcystis spp.* that produce the toxin microcystin have detrimental impacts on multiple levels, from disruption of zooplankton grazing to illness and mortality in animals and humans. Thus, it is of great concern that microcystin concentrations above the World Health Organization's recommended limit for drinking water (1 µg/L) have been measured in parts of Lake Huron and western Lake Erie, with particularly high concentrations in wind-accumulated scums. However, not all *Microcystis* strains produce toxins and traditional microscopic analyses are insufficient for discerning whether a bloom is composed of toxic strains. Instead, genetic analyses based on the *mcyB* gene, which is involved in cellular microcystin production, were used to differentiate toxic vs. non-toxic strains and specifically detect the presence of toxic strains of *Microcystis* in environmental samples.

Hypothesis

The use of *mcyB* gene can differentiate toxic and non-toxic *Microcystis* spp. that can potentially produce microcystin toxins.

Methods

Genetic analyses based on the *mcyB* gene, which is involved in cellular microcystin production, were used to differentiate toxic vs. non-toxic strains and specifically detect the presence of toxic strains of *Microcystis* in environmental samples.

Results

DNA sequence analysis of the *mcyB* gene revealed a genetically variable population of *Microcystis* in Saginaw Bay (Lake Huron) and western Lake Erie, with areas containing a greater proportion of toxic *Microcystis* strains also having higher microcystin concentrations, suggesting that changes in bloom toxicity may be the result of shifts in community composition. Another cyanobacterial HAB species, *Cylindrospermopsis raciborskii,* has also recently been detected in the Great Lakes and studies of its distribution and toxicity in this system are on-going

Conclusion

The application of these methods to monitoring and modeling efforts will be important to protect human and ecosystem health in the Great Lakes region.